Vanderbilt Group Introduction

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EIC Tracking R&D meeting

09/21/2020

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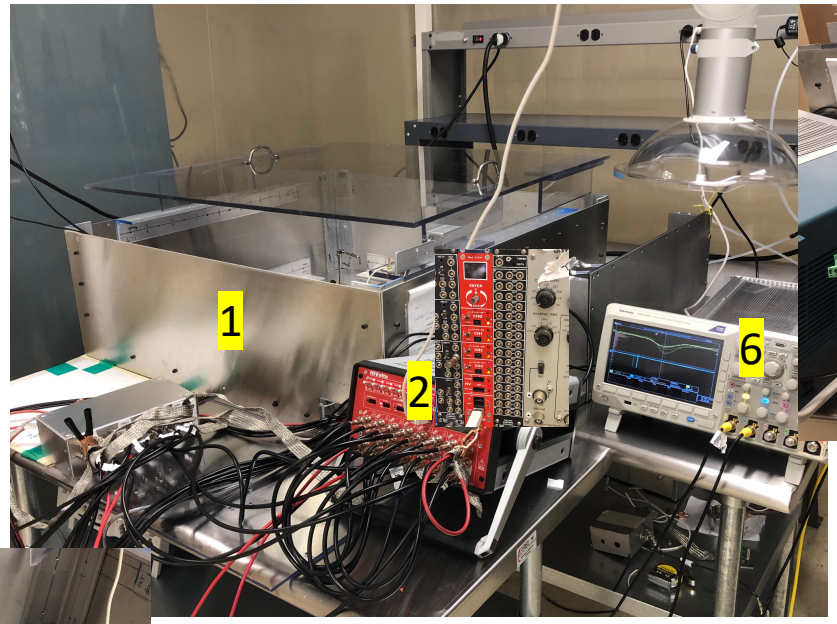
Vanderbilt group composition

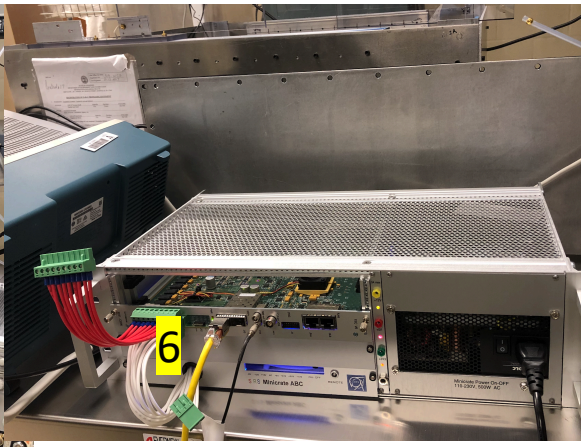
- Two Professors (Julia Velkovska and Vicki Greene)
- One research assistant professor (Sourav Tarafdar) and two postdocs
- 6 graduate students
- 1-2 undergraduates (more can be recruited as needed)

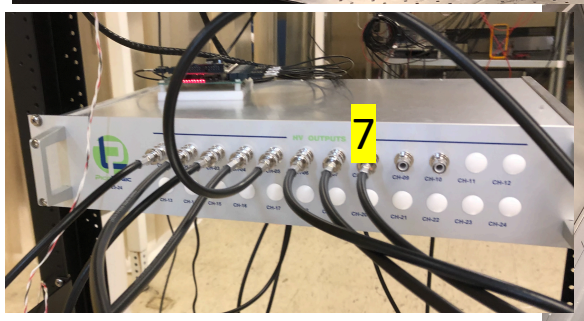
Research

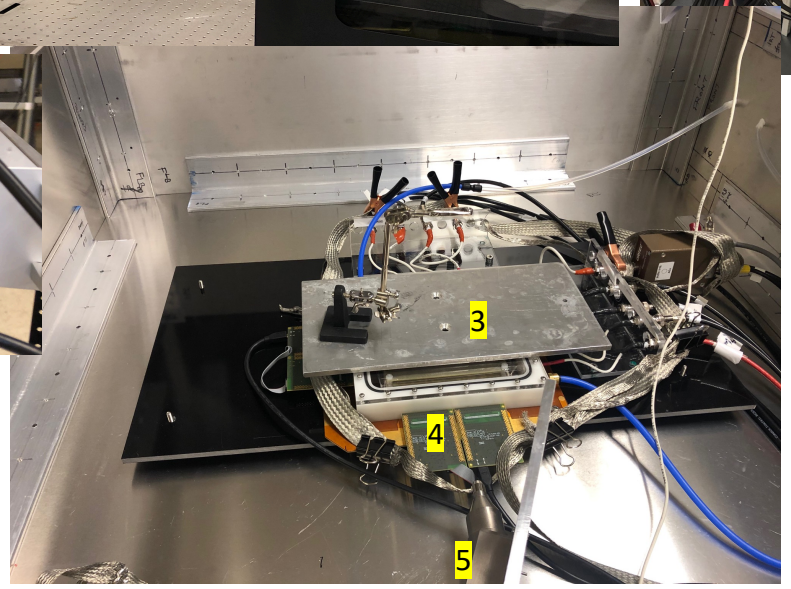
- **PHENIX :**
  - Construction and operation of Pad-Chambers and Time of Flight West
  - Identified particle production and flow measurements, including flow of heavy-flavor particles
- **CMS :**
  - Tier 2 computing
  - Measurements of collective flow, strange particles, high-pt charged particles, jets, jet substructure
- **sPHENIX :**
  - sPHENIX TPC GEM assembly factory
  - Tracking software
- **JetScape/X-scape collaboration**
  - Model-to-data comparisons; studies of collectivity and jet-quenching in small systems

Vanderbilt MPGD Research Facility



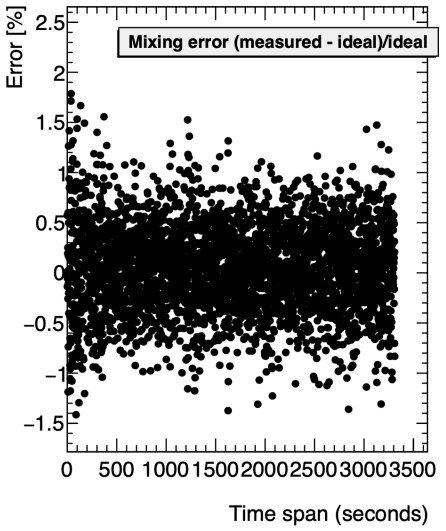






Available equipment (not all listed) :

1. MPGD R&D bench
2. 8+4 channel two CAEN HVPS
3. 10X10 cm^2multilayer GEM detector
4. APV cards with SRS
5. Mini X-ray tube for IBF measurement
6. DAQ (scope + SRS)
7. 10 channel Zagreb picoammeter
8. In house build 3 gas mixing unit (mixing inaccuracy of +/- 0.5% as on right hand plot)



Thanks to Bob Azmoun for suggestions

Additional engineering support : Availability of Physics department machine shop

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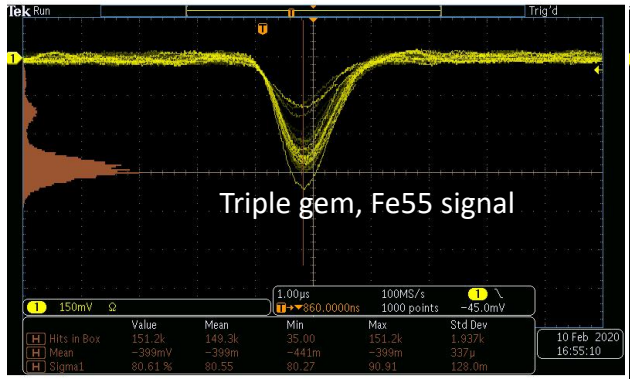
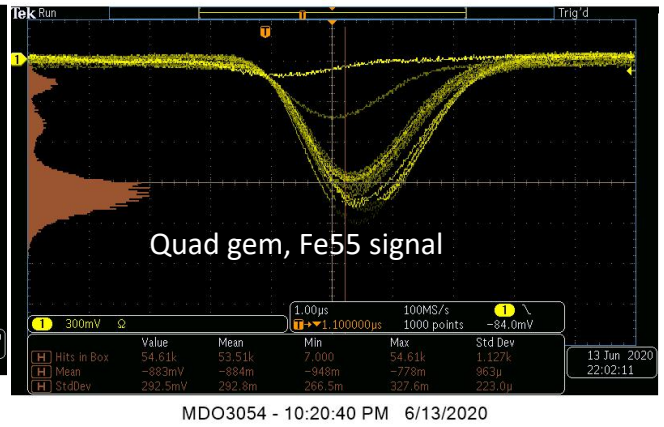
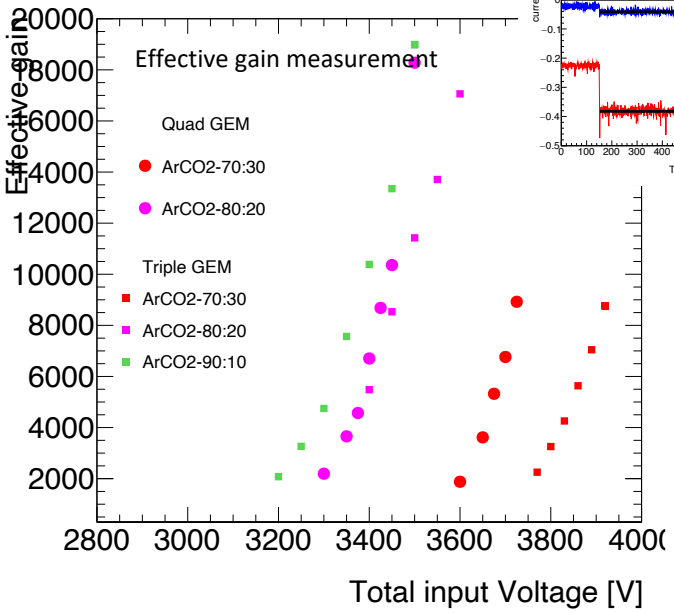
Results from multilayered GEM detector in Vanderbilt MPGD lab

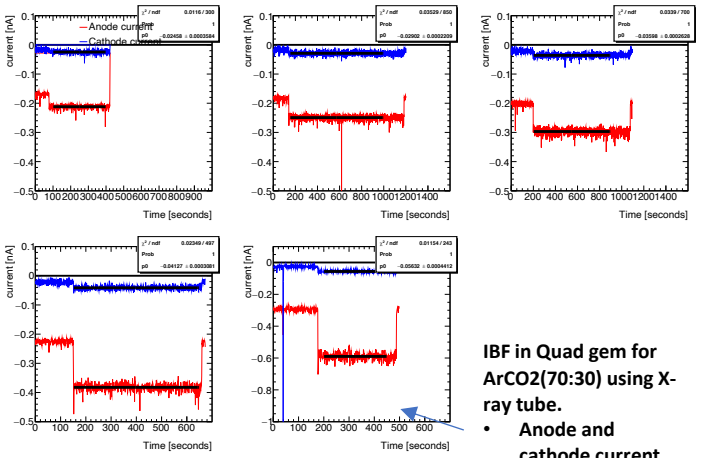
- Several studies for triple and quad GEM detectors were done for ArCO2 gas mixtures using 10x10 standard GEMs.
- Initial study used voltage divider for biasing detector electrodes.
- Spectra is measured from bottom of last GEM using electronics chain of preamp + shaping amp + scope

Results 1 : Using voltage divider



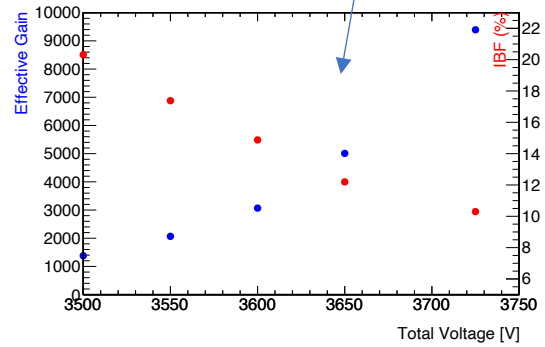




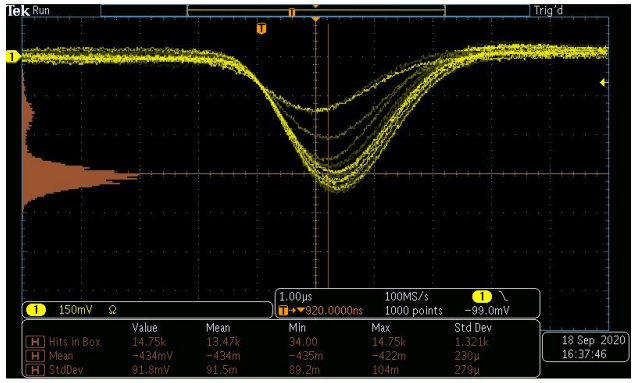


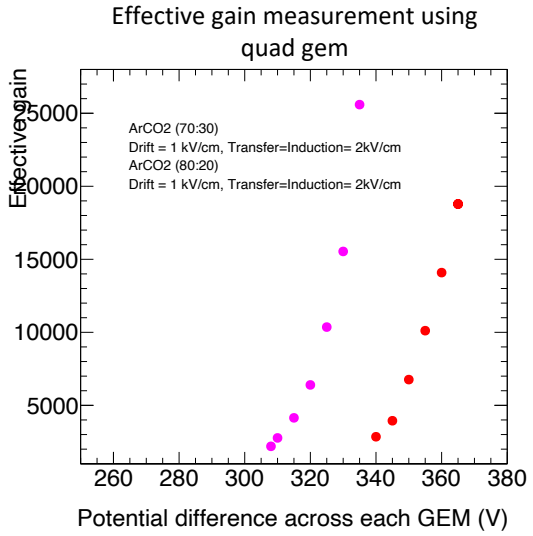
IBF in Quad gem for ArCO2(70:30) using X-ray tube.

- **Anode and cathode current**
- **IBF and effective gain correlation**



Results 2 : Using individual channel of HVPS on Quad GEM





Activities on track :

- In the process of getting Fe-55 spectra using SRS (Thanks to Martin for setting it up !).
- Study the effect of gap fields on IBF .
- Using misaligned gem holes for IBF blocking.
- Performance study of hybrid MPGD

Future Plans

- The Vanderbilt MPGD lab is well equipped for performing MPGD related R&D for EIC tracking
- Hardware and software expertise, and track record of completing challenging projects
- The group is committed to EIC research, including detector R&D, construction, and eventually – data analysis
- Close collaboration with BNL (Craig Woody et.al.) is envisioned for studying different readout pads for TPC using GEMs, and also a hybrid MPGD detector.